



# Task 7 Update to PES WG

3.14.22



# Eight Tools

- **Holos**
- **DayCent**
- **COMET-Farm**
- **COMET-Planner**
- **Integrated Farm System Model**
- **DNDC**
- **EPIC/APEX**
- **COOL-Farm**

# Considerations

- **Tool Characteristics**
  - LCA
  - Includes relevant LUCs
    - Forests, wetlands, etc.
  - Follows IPCC
  - Model-type
- **Considerations**
  - Available Data
  - Applied Uses (PES, other orgs)
  - Socio-economic impacts



# SWOT Analysis

- **Strengths**
  - Accuracy, Usability, Possible other applications
- **Weaknesses**
  - Inaccurate, Difficult to use, missing key factors (ex. enteric emissions)
- **Opportunities**
  - Tool Access, Developing Technology, Support
- **Threats**
  - Limited resources for training technicians or compiled state data

# Three Case Studies

- Farm Level Environmental Assessment of Organic Dairy Systems: LCA
  - Tools can be integrated with other data sources to fill information gaps
- Logiag Carbon Project
  - Using a tool to set a baseline, inform management decisions
- He Waka Eke Noa
  - Strategy pursued by farmer initiative to reduce whole-sector emissions based on self-reported whole farm data. Considering using central-calculator where individual farms can input their data.

# Model Parameters

Program	Modeling approach (empirical, process-based, emissions factors)	Scope of analysis (crop, fields, whole farm (includes production site/manure management, fuel use))	Time-step (Daily, monthly, yearly)	Geographical scope (U.S., international)	Model calibrated (list regions)	Farm type (main crops, dairy, livestock, etc.)
Holos	Emissions factors	Whole Farm	Yearly	Canada	Canada Eco-districts	18 types of crops, beef, dairy, swine, poultry, other livestock
DayCent	Process-based	Crop, fields	Daily	International		Major crops and grassland
Comet-Farm						
Comet-Planner						
Integrated Farm System Model	Process-based	Whole Farm	Daily	US & Canada	Primarily northern US and southern Canada	Main crops, dairy, and beef
DNDC	Process-based	Field C&N cycling	Daily	International	International	Crops and livestock
EPIC/ APEX	Process-based	Whole Farm	Daily	International	International, but only for select nations	Extensive Crops
Cool-Farm	Emissions factors	By crop or livestock type; biodiversity at a whole-farm scale	Annual	International	International	Emission footprint can be generated separately by crop or livestock, aggregates for whole-farm assessment

# Model Outputs

Table 3. Model output

Program	Scale (IPCC TIER)	GHG emission reduction (NO <sub>2</sub> , N <sub>2</sub> O, CH <sub>4</sub> , CO <sub>2</sub> )	Enteric emissions (y/n)	Carbon sequestration (y/n)	Water quality (N & P reduction to surface water)	Biodiversity (soil, insects, mammals, plants, in-field, edge-of-field, none)
Holos	IPCC 2 & 3	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O	Y	Y	forthcoming in next version	N
DayCent	IPCC 3	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, NO <sub>x</sub> , N <sub>2</sub>	N	Y	Some NO <sub>3</sub> leaching, but lacks hydrological model	N
Comet-Farm						
Comet-Planner						
Integrated Farm System Model	IPCC 2	CO <sub>2</sub> , N <sub>2</sub> O, CH <sub>4</sub>	Y	Y	Y (N leaching and P loss by erosion)	N
DNDC	IPCC 3	N <sub>2</sub> O, NO, N <sub>2</sub> , NH <sub>3</sub> , CH <sub>4</sub> & CO <sub>2</sub>	Y, in Manure-DNDC	Y	Y	N
EPIC/APEX	IPCC 3	CO <sub>2</sub> , NO <sub>2</sub> , N <sub>2</sub> O, N <sub>2</sub> , O <sub>2</sub> ,	N	Y	Y	N
Cool-Farm	IPCC 1 & 2	CO <sub>2</sub> , N <sub>2</sub> O, CH <sub>4</sub>	Y	Y	N	Y (whole farm)